

NON-PUBLIC?: N  
ACCESSION #: 9001030256

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Waterford Steam Electric Station Unit 3 PAGE: 1 OF 5

DOCKET NUMBER: 05000382

TITLE: Reactor Trip due to Complications Associated wit Control Element  
Assembly

EVENT DATE: 08/19/89 LER #: 89-017-01 REPORT DATE: 12/29/89

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 023

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: R. S. Starkey, Operations Superintendent

TELEPHONE: 504-464-3134

COMPONENT FAILURE DESCRIPTION:  
CAUSE: B SYSTEM: AA COMPONENT: MANUFACTURER: E146  
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At 1319 hours on August 19, 1989, an automatic reactor trip of Waterford Steam Electric Station Unit 3 occurred while operating at 23% power. The trip was initiated by the Plant Protection System (PPS) in response to variations in core axial shape index (ASI), a measure of core power distribution, induced by the down power required for an abnormal control element assembly (CEA) configuration. This event is reportable as an automatic reactor protection system actuation.

The root cause of this event is equipment malfunction. During routine CEA operability testing, CEA 18 would not move in either direction. After repairs were made to CEA control circuitry, CEA 18 was inserted below the Technical Specification (TS) limit of 145 inches while

verifying response. CEA 18 would not withdraw, necessitating a reactor power reduction per TSs. While attempting to control ASI subsequent to the power reduction, the reactor tripped. The defective equipment has been replaced and tested satisfactorily. Because protective features functioned as designed, the health and safety of the general public or plant personnel was not adversely affected by this event.

END OF ABSTRACT

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At 1319 hours on August 19, 1989, an automatic reactor trip of Waterford Steam Electric Station Unit 3 occurred while operating at 23% power. The trip was initiated by the Plant Protection System (PPS) (EIIS Identifier - JC) in response to changes in core axial shape index (ASI) induced by the down power required for an abnormal control element assembly (CEA) (EIIS Identifier AA-ROD) configuration. This event is reportable as an automatic reactor protection system actuation.

At 0925 hours on August 19, 1989, during CEA testing per Operating Procedure (OP) 903-005, "CEA Operability Check", CEA 18 failed to move in either direction. Operations personnel immediately entered OP-901-009, "CEA/Control Element Drive Mechanism Control System (CEDMCS) Malfunction," while Instrumentation and Controls (I&C) personnel initiated troubleshooting to determine the cause of the CEA malfunction. Technical Specification (TS) 3.1.3.1 action requirement f was also entered which allows continued operation in modes 1 and 2 provided the CEA remains above 145 inches. The "pulldown" and "lower gripper" coil current sensors for the CEA were replaced. At 1040 hours CEA 18 was inserted to 140 inches, below the TS limit of 145 inches, while verifying the operability of the replacement sensors. The operator attempted to withdraw CEA 18 above 145 inches but the CEA failed to move outward. TS 3.1.3.1 action requirement d and 3.1.3.5 action requirement b were then implemented.

The Waterford 3 PPS utilizes core protection calculators (CPCs) (EIIS Identifier IC-CPU). The CPCs are computers that monitor plant parameters to calculate Local Power Density (LPD) and Departure from Nucleate Boiling Ratio (DNBR) and initiate a reactor trip at predetermined values. The CEA input to each CPC is unique in that 23 CEAs are targeted to each CPC. CEA 18 is targeted to PPS channel "A" and its insertion affected the CPC calculation resulting in a trip of the "A" PPS on high LPD and low DNBR. With channel "A" tripped, no reactor trip would occur but the PPS would now be effectively in a 1 out of 3 logic vice the normal 2 out of 4 logic on DNBR and LPD.

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TS 3.1.3.5.b requires all shutdown CEAs to be withdrawn greater than 145 inches during Modes 1 and 2 or the shutdown margin (SDM) requirements of TS 3.1.1.1 must be satisfied within one hour and the plant placed in hot standby within 6 hours. Additionally, with CEA 18 at the 140 inches withdrawn position, a deviation of 8 inches existed between CEA 18 and the other CEAs in its group. TS 3.1.3.1.d requires that with greater than 7 inches misalignment between CEAs in the same group, power shall be reduced by 30%, or to below 60% power within 1 hour. The required power reduction was commenced at 1057 hours and completed at 1136 hours. SDM requirements were believed to be satisfied per TS 4.1.1.1.b; however, coincident with the power reduction, SDM calculations were commenced per OP-903-090, "Shutdown Margin". One additional action requirement of TS 3.1.3.1.d was not satisfied: aligning the remainder of the CEAs in the group with the inoperable CEA to within 7 inches. This established the 6 hour hot standby requirement of TS 3.1.3.1.d and TS 3.1.3.5.b as the controlling action.

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The reactor was nearing End of Core Life (EOL) and xenon buildup resulting from the 30% power reduction caused variations in ASI, making ASI control difficult. ASI is derived by dividing the difference between power generated in the lower and upper halves of the core by the total power generated in the core. With ASI trending increasingly negative, group 6 and Part-Length CEAs (PLCEAs) were inserted in an attempt to establish ASI control. Step 8.5 of OP-903-090 incorrectly specified additional boron required for an inoperable CEA; therefore, after calculating SDM, a batch addition of boric acid was made to the Reactor Coolant System (RCS) (EIIS Identifier - AB) commencing at 1226 hours. Group 6 CEAs were then withdrawn to compensate for the negative reactivity inserted by the boration in order to level power and RCS temperature. However, because of confusion over the SDM calculation procedure, boron added to meet TS 3.1.1.1 was later determined to be not required. An immediate change to OP-903-090 step 8.5 was made to correctly require additional boron for "An Immovable/Untrippable" CEA vice "An Inoperable" CEA. Boration was secured at 1250 hours, but the addition of boron resulted in a rapid power reduction to a lower power level than required. At 1307 hours, ASI was observed to be -0.25, bordering on the TS 3.2.7 requirement of -0.27. RCS dilution to reduce boron concentration was commenced but was unable to stabilize power. At 1319 the reactor tripped on a CPC Channel "C" auxiliary trip (ASI greater than -0.5) with CPC Channel "A" in trip from the CEA 18 insertion. An auxiliary trip initiates LPD and DNBR trips when certain variables used

in the CPC algorithm exceed their limits. ASI more negative than -0.5 is a CPC algorithm limit.

The root cause of the event that led to the reactor trip is equipment malfunction. Failure of the pulldown and lower gripper coil current sensors impaired the operation of CEA 18. The cause of the reactor trip was personnel error in that the licensed operator inserted CEA 18 below its TS limit of 145 inches. Contributing to the event was an inadequate procedure (OP 903-090) which hampered timely calculation of SDM. After initial corrective action the operator attempted to withdraw CEA 18 in accordance with TS 3.1.3.5, but the replacement pulldown coil current sensor drawn from warehouse supplies did not function as required, preventing withdrawal of CEA 18.

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The current sensors involved are supplied by Electro Mechanics company (a division of Combustion Engineering) and are factory adjusted. A method to perform on-site operability verification of these, components is being pursued to preclude the installation of defective components during troubleshooting and repairs. This method should be in place by June 30, 1990. Station Modification Request (SMR) CED-003 is being reviewed for implementation to modify CEA software to enlarge the window of acceptable current received from the current sensors in the CEA circuitry. This modification would improve the circuit compatibility of replacement components.

The operator involved in inserting CEA 18 below the TS limit has been counselled on proper monitoring of CEA position indication during manual CEA motion. OP-903-090 has been revised to remove the inconsistencies in the SDM calculation.

ASI control becomes difficult late in core life as the peak power distribution moves up in the core. The TS requirement for a large power reduction (30%) in a relatively short time (1 hour) further aggravates this condition. TS 3.1.3.1.d. will be evaluated for possible changes in order to allow for more manageable ASI control late in core life. A case study has been developed for use in operator training which emphasizes the importance of maintaining proper CEA alignment and control of reactor power, especially late in core life. Because all protective features functioned as designed, this event did not threaten the health and safety of the general public or plant personnel.

Similar events where a reactor trip occurred due to ASI being outside of the allowable algorithm range of + or - 0.5, resulting in a CPC initiated auxiliary trip were reported in LERs 85-032, 86-025, and 88-001.

PLANT CONTACT

R.S. Starkey, Operations Superintendent, 504/464-3134

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Ref: 10CFR50.73(a)(2)(iv)

LOUISIANA

POWER & LIGHT / WATERFORD 3 SES - P.O. BOX B - KILLONA, LA 70066-0751

MIDDLE SOUTH

UTILITIES SYSTEM

W3A89-0217

A4.05

QA

December 29, 1989

U.S. Nuclear Regulatory Commission  
ATTENTION: Document Control Desk  
Washington, D.C. 20555

Subject: Waterford 3 SES  
Docket No. 50-382  
License No. NPF-38  
Reporting of Licensee Event Report

Dear Gentlemen:

Attached is Licensee Event Report Number LER-89-017-01 for Waterford Steam Electric Station Unit 3. This Licensee Event Report is submitted pursuant to 10CFR50.73(a)(2)(iv) and provides supplemental information required by 10CFR50.73 which addresses the concerns raised in Inspection Report 50-382/89-34.

Very truly yours,

J.R. McGaha  
Plant Manager - Nuclear

JRM/KTW:glp

(w/Attachment)

cc: Messrs. R.D. Martin  
J.T. Wheelock - INPO Records Center  
E.L. Blake  
W.M. Stevenson  
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NRC Resident Inspectors Office

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